IEM's AI Modeling: Short-term COVID-19 Projections

Date: 3/4/22

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 3/4/22 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

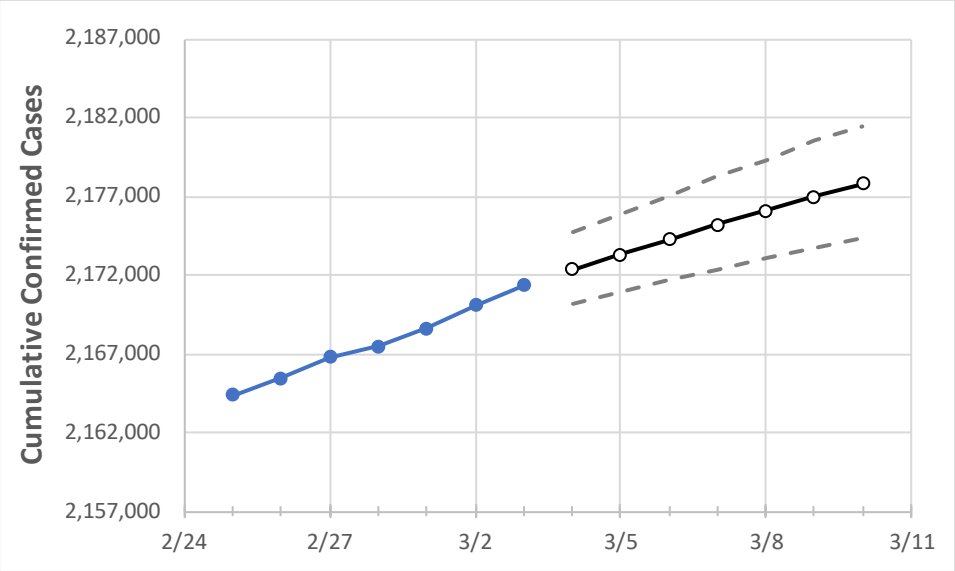
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

New Jersey State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
New Jersey	2,167,515	2,168,631	2,170,061	2,171,339	2,172,337	2,173,340	2,174,261	2,175,216	2,176,118	2,177,011	2,177,820

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Bergen	218,390	218,518	218,696	218,866	218,983	219,093	219,206	219,310	219,414	219,519	219,624
Burlington	100,791	100,821	100,835	100,870	100,899	100,925	100,950	100,972	100,996	101,018	101,037
Camden	124,135	124,173	124,220	124,291	124,328	124,364	124,397	124,430	124,460	124,493	124,518
Essex	209,068	209,147	209,272	209,367	209,454	209,535	209,617	209,696	209,771	209,845	209,921
Gloucester	68,982	69,010	69,049	69,085	69,112	69,137	69,161	69,182	69,205	69,227	69,248
Hudson	167,890	167,990	168,101	168,194	168,287	168,379	168,469	168,555	168,641	168,727	168,809
Hunterdon	24,107	24,117	24,130	24,149	24,161	24,175	24,187	24,199	24,211	24,222	24,234
Mercer	74,537	74,570	74,641	74,687	74,714	74,740	74,765	74,789	74,811	74,835	74,854
Middlesex	188,759	188,943	189,179	189,283	189,433	189,584	189,727	189,876	190,021	190,167	190,306
Monmouth	161,308	161,401	161,484	161,567	161,633	161,698	161,761	161,821	161,882	161,940	161,997
Morris	116,263	116,316	116,370	116,465	116,521	116,575	116,624	116,669	116,719	116,768	116,812
Ocean	159,731	159,794	159,865	159,941	159,998	160,056	160,107	160,160	160,211	160,260	160,307
Passaic	142,319	142,373	142,451	142,548	142,597	142,645	142,692	142,738	142,781	142,828	142,870
Somerset	66,350	66,400	66,435	66,469	66,504	66,539	66,571	66,605	66,636	66,669	66,699
Sussex	33,398	33,415	33,443	33,463	33,481	33,498	33,515	33,532	33,548	33,566	33,580
Union	142,393	142,476	142,590	142,653	142,725	142,799	142,864	142,930	142,994	143,056	143,123
Warren	23,531	23,540	23,554	23,567	23,577	23,587	23,597	23,606	23,615	23,625	23,633

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

New Jersey Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	2/28	3/1	3/2	3/3	3/5	3/7	3/9
Bergen	218,390	218,518	218,696	218,866	219,093 (43,819) [10,516] {5,258}	219,310 (43,862) [10,527] {5,263}	219,519 (43,904) [10,537] {5,268}
Burlington	100,791	100,821	100,835	100,870	100,925 (20,185) [4,844] {2,422}	100,972 (20,194) [4,847] {2,423}	101,018 (20,204) [4,849] {2,424}
Camden	124,135	124,173	124,220	124,291	124,364 (24,873) [5,969] {2,985}	124,430 (24,886) [5,973] {2,986}	124,493 (24,899) [5,976] {2,988}
Essex	209,068	209,147	209,272	209,367	209,535 (41,907) [10,058] {5,029}	209,696 (41,939) [10,065] {5,033}	209,845 (41,969) [10,073] {5,036}
Gloucester	68,982	69,010	69,049	69,085	69,137 (13,827) [3,319] {1,659}	69,182 (13,836) [3,321] {1,660}	69,227 (13,845) [3,323] {1,661}
Hudson	167,890	167,990	168,101	168,194	168,379 (33,676) [8,082] {4,041}	168,555 (33,711) [8,091] {4,045}	168,727 (33,745) [8,099] {4,049}
Hunterdon	24,107	24,117	24,130	24,149	24,175 (4,835) [1,160] {580}	24,199 (4,840) [1,162] {581}	24,222 (4,844) [1,163] {581}
Mercer	74,537	74,570	74,641	74,687	74,740 (14,948) [3,588] {1,794}	74,789 (14,958) [3,590] {1,795}	74,835 (14,967) [3,592] {1,796}
Middlesex	188,759	188,943	189,179	189,283	189,584 (37,917) [9,100] {4,550}	189,876 (37,975) [9,114] {4,557}	190,167 (38,033) [9,128] {4,564}
Monmouth	161,308	161,401	161,484	161,567	161,698 (32,340) [7,762] {3,881}	161,821 (32,364) [7,767] {3,884}	161,940 (32,388) [7,773] {3,887}
Morris	116,263	116,316	116,370	116,465	116,575 (23,315) [5,596] {2,798}	116,669 (23,334) [5,600] {2,800}	116,768 (23,354) [5,605] {2,802}
Ocean	159,731	159,794	159,865	159,941	160,056 (32,011) [7,683] {3,841}	160,160 (32,032) [7,688] {3,844}	160,260 (32,052) [7,692] {3,846}
Passaic	142,319	142,373	142,451	142,548	142,645 (28,529) [6,847] {3,423}	142,738 (28,548) [6,851] {3,426}	142,828 (28,566) [6,856] {3,428}
Somerset	66,350	66,400	66,435	66,469	66,539 (13,308) [3,194] {1,597}	66,605 (13,321) [3,197] {1,599}	66,669 (13,334) [3,200] {1,600}
Sussex	33,398	33,415	33,443	33,463	33,498 (6,700) [1,608] {804}	33,532 (6,706) [1,610] {805}	33,566 (6,713) [1,611] {806}
Union	142,393	142,476	142,590	142,653	142,799 (28,560) [6,854] {3,427}	142,930 (28,586) [6,861] {3,430}	143,056 (28,611) [6,867] {3,433}
Warren	23,531	23,540	23,554	23,567	23,587 (4,717) [1,132] {566}	23,606 (4,721) [1,133] {567}	23,625 (4,725) [1,134] {567}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.